

Pushing the

RADIAL

VELOCITY

accuracy



Xavier

DUMUSQUE

Can we **improve** the **radial velocity precision** of
HARPS and HARPS-N ?

INSTRUMENT

&

REDUCTION

How do we derive precise RV measurements?

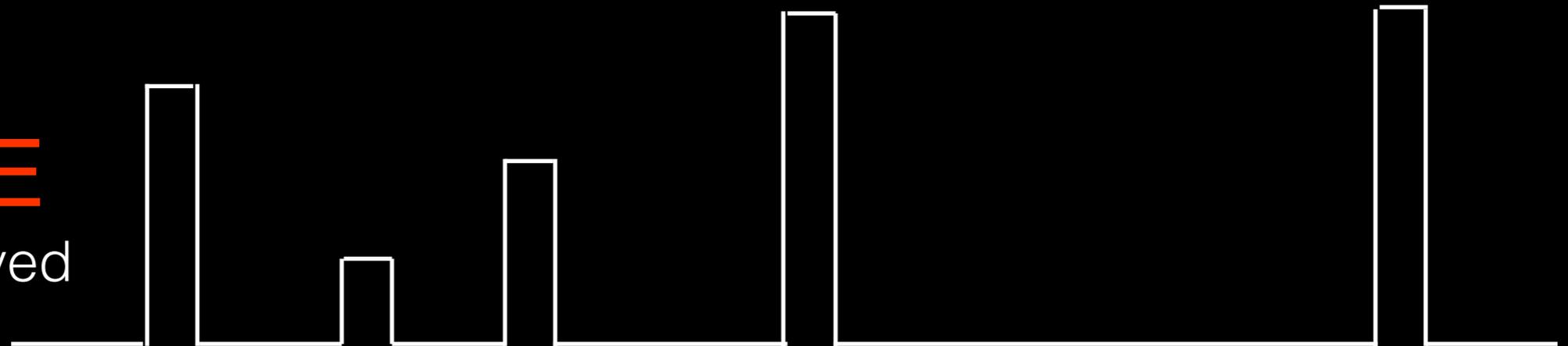
SPECTRUM

visible spectrum



TEMPLATE

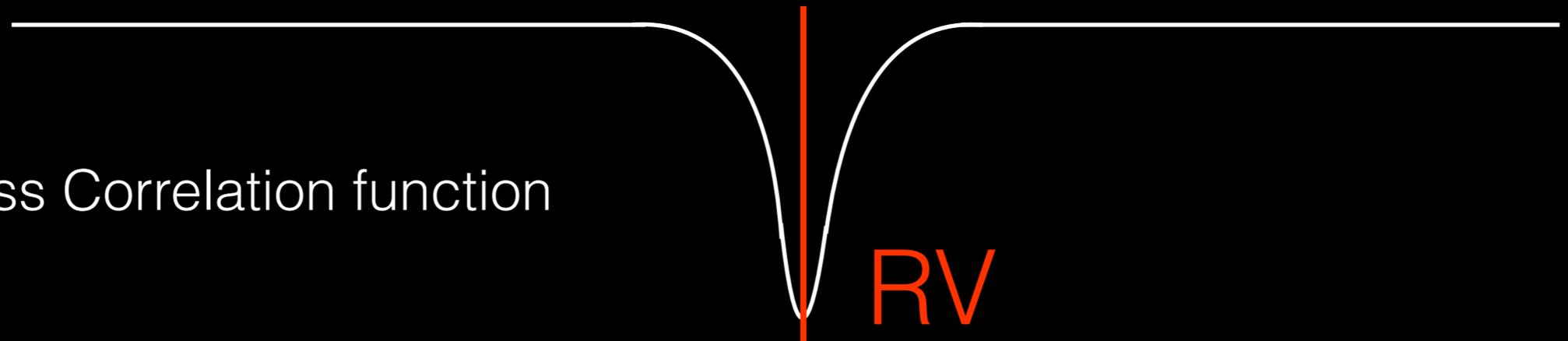
synthetic or observed



=

CCF

Cross Correlation function



Precise RV measurements

Can **all the lines** be used to derive **precise RVs**?

ACTIVITY

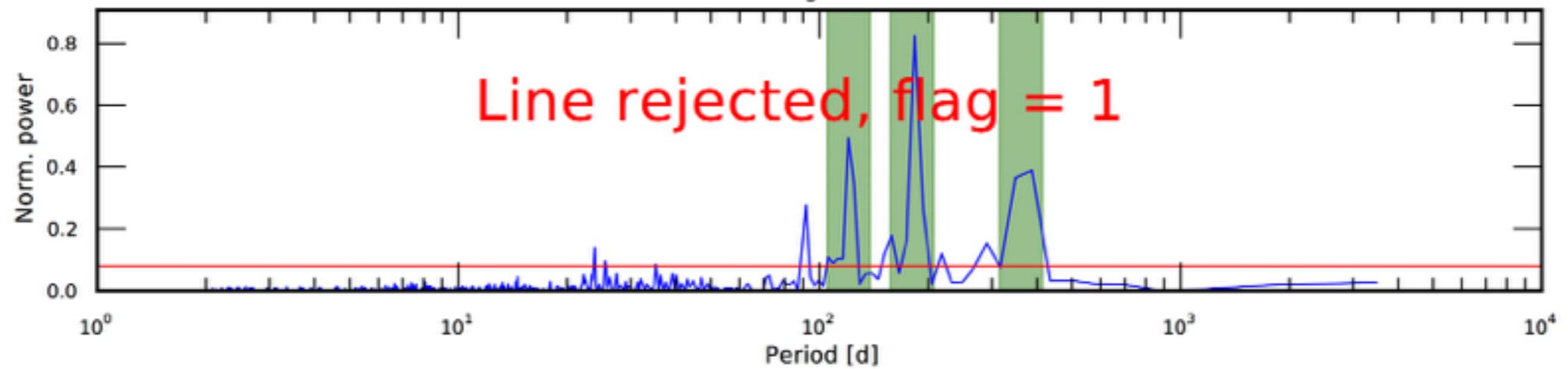
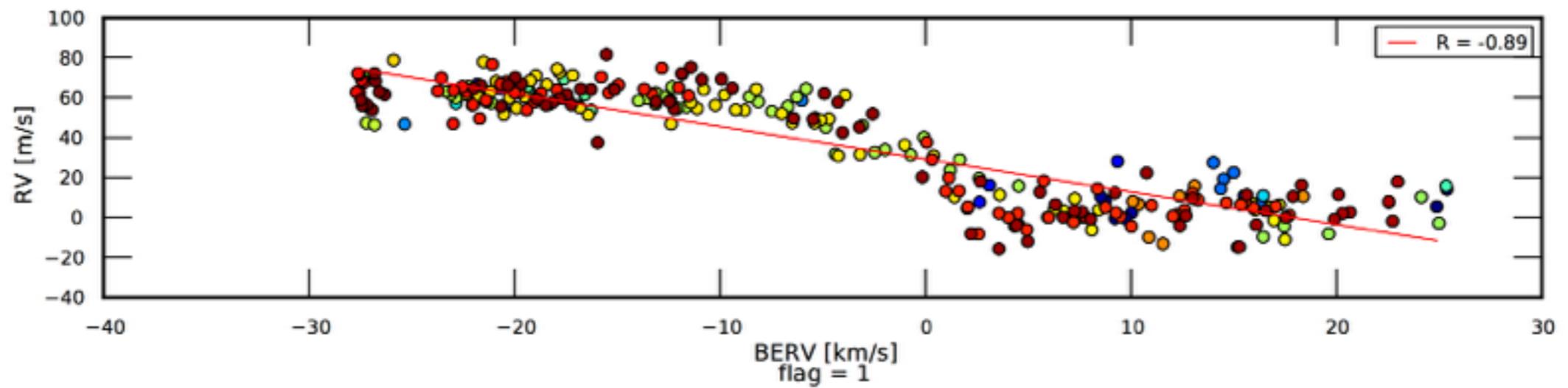
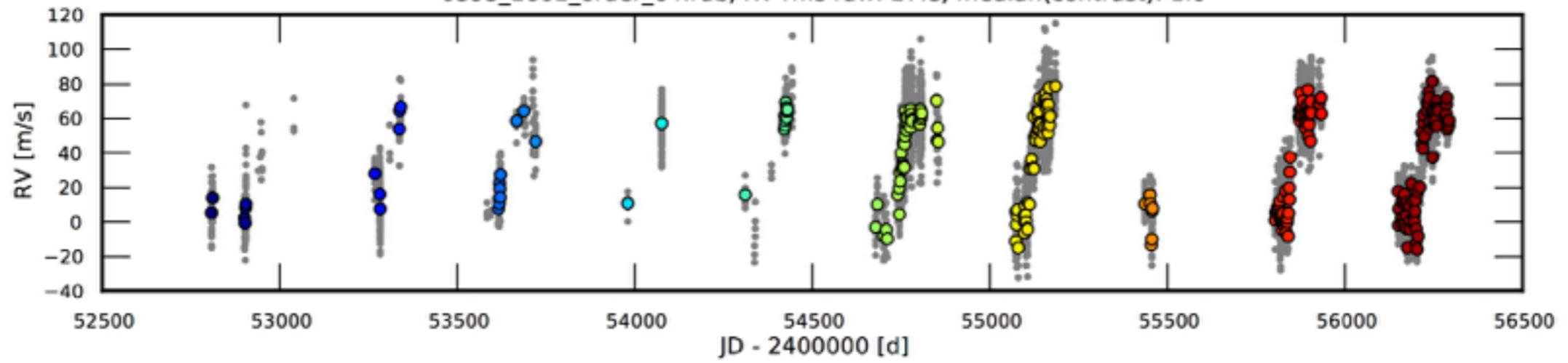
TELLURICS

CCD POSITION

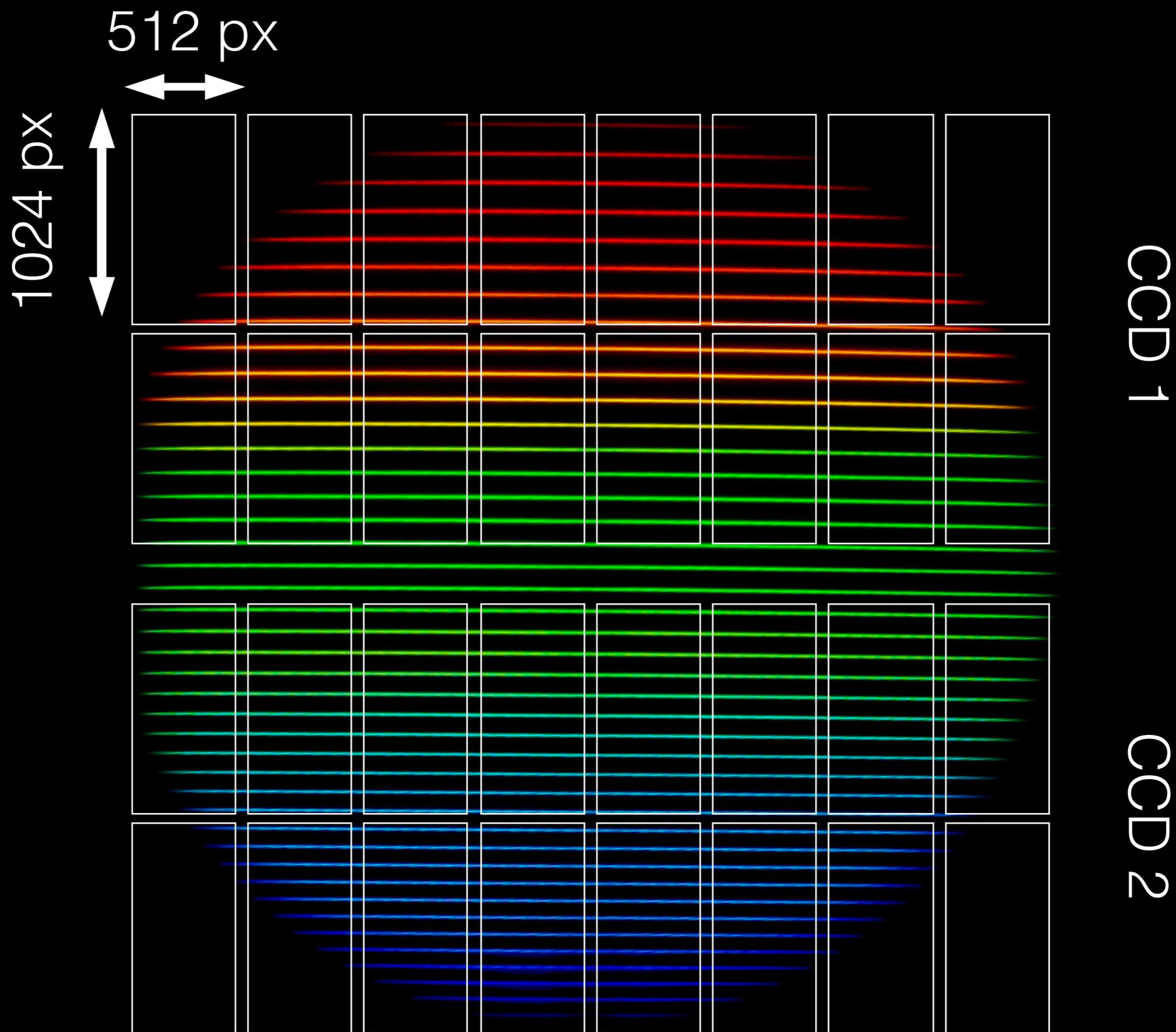
RV

of each individual spectral line

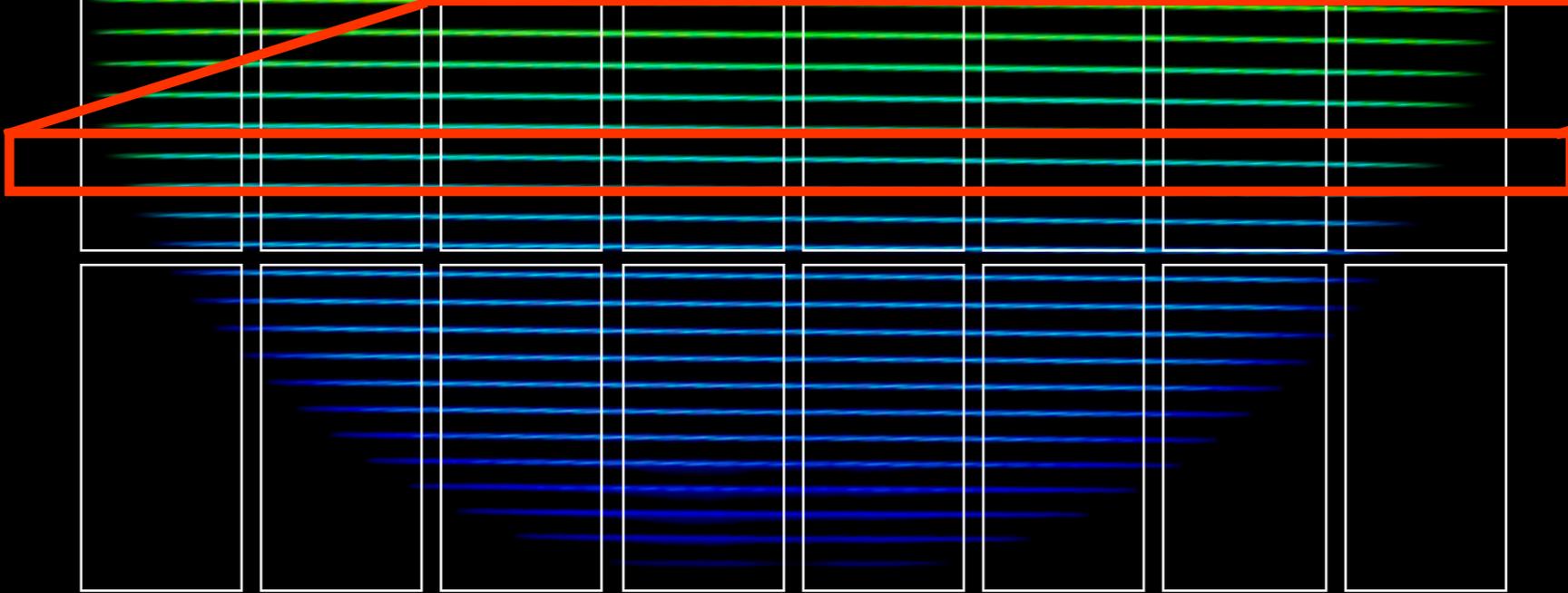
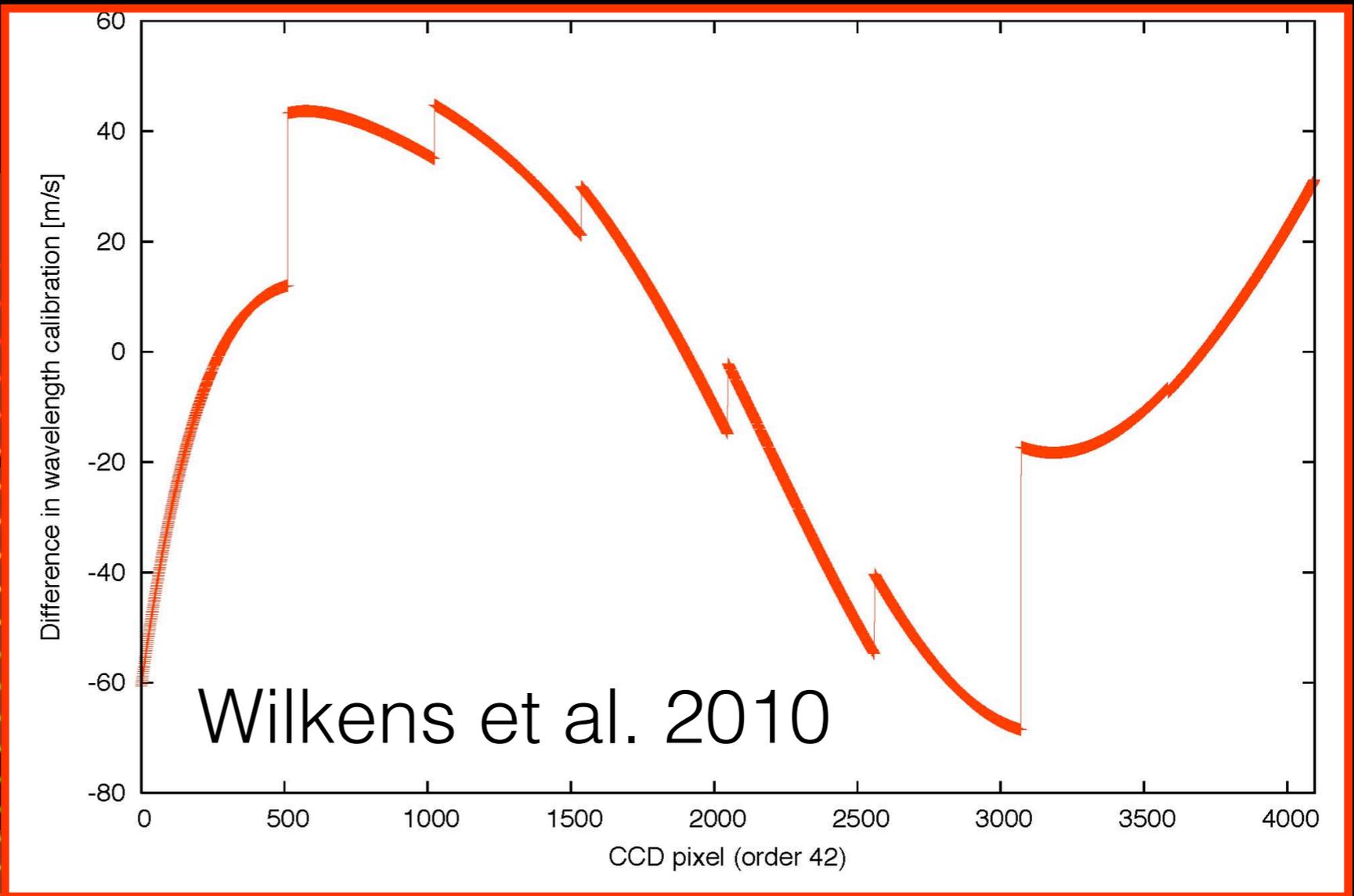
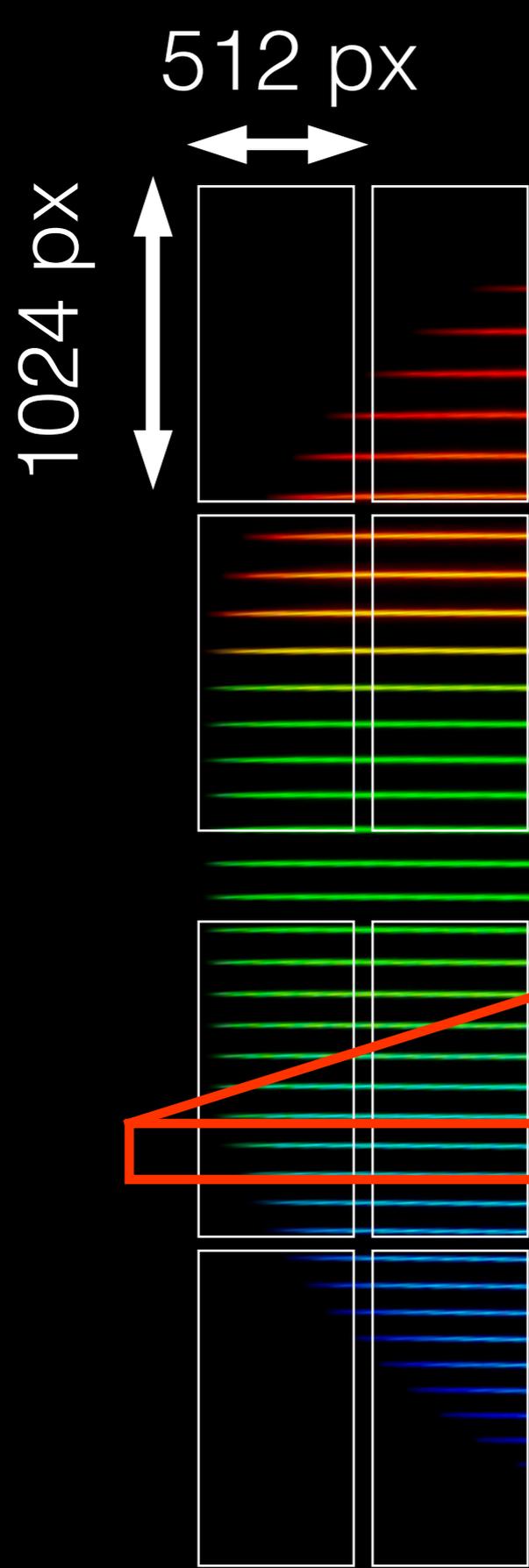
6393_2602_order_64.rdb, RV rms raw: 27.8, median(contrast): 1.0



Position on the **CCD**

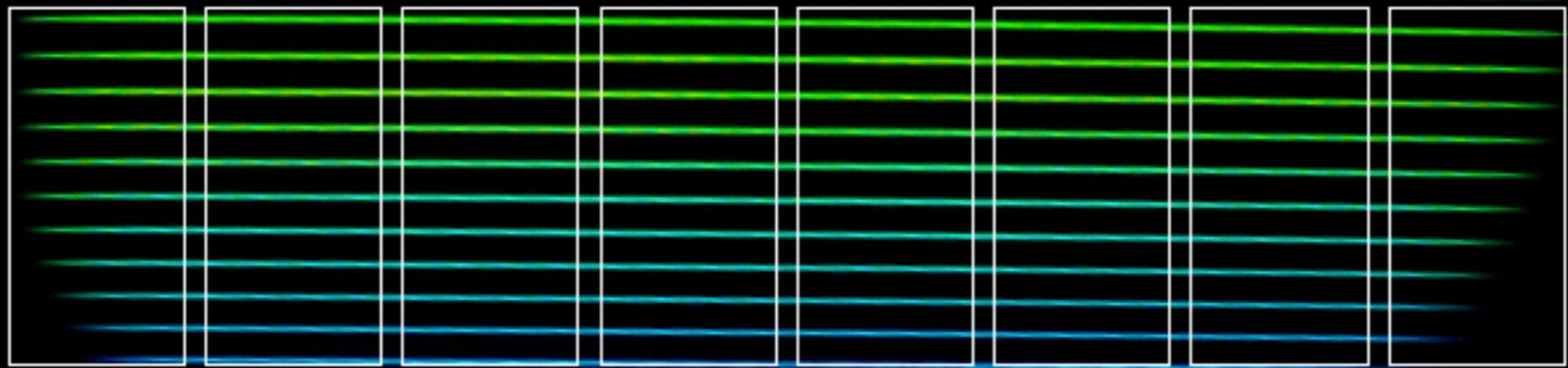


Position on the CCD

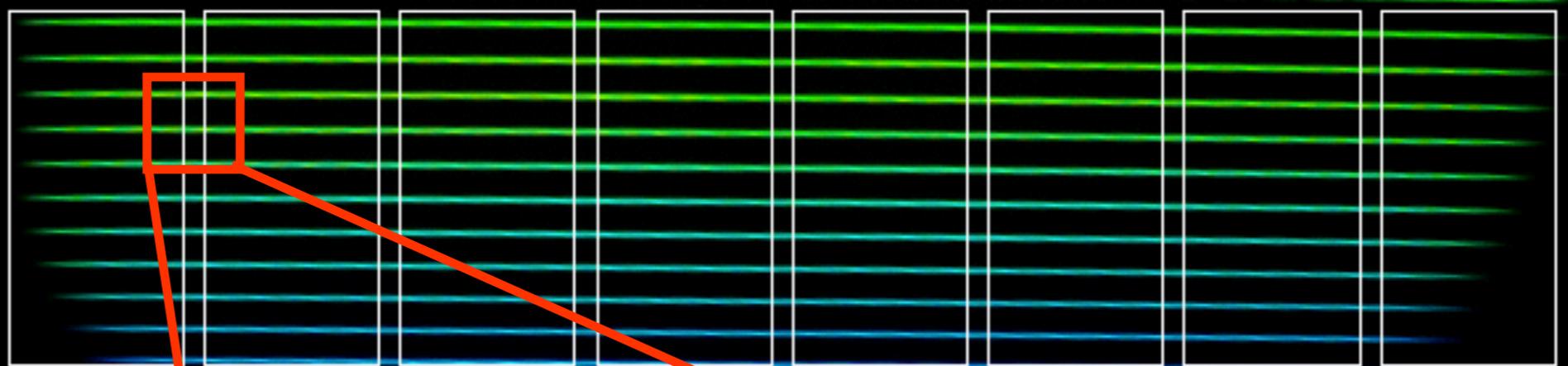


CCD 2

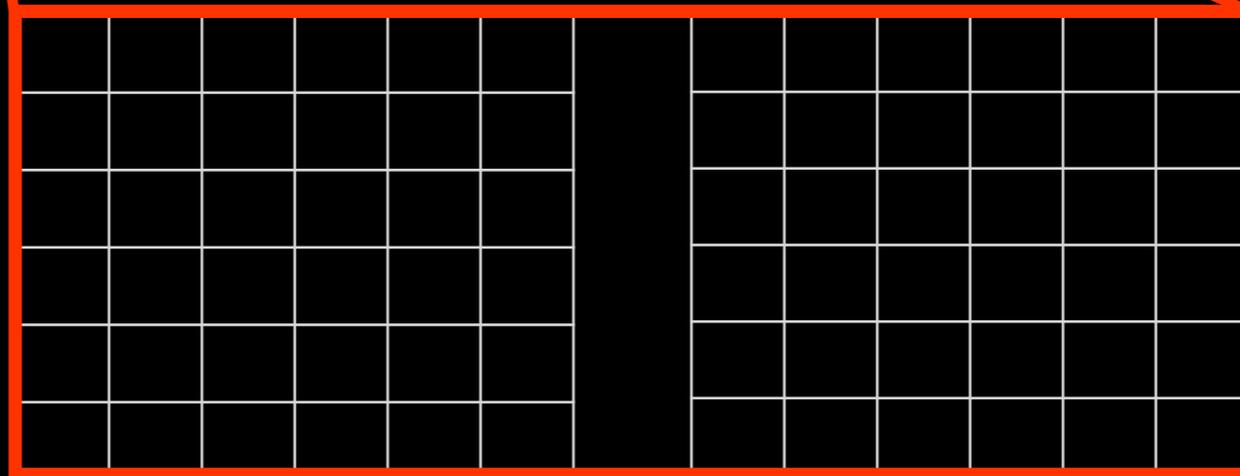
CCD Stitching



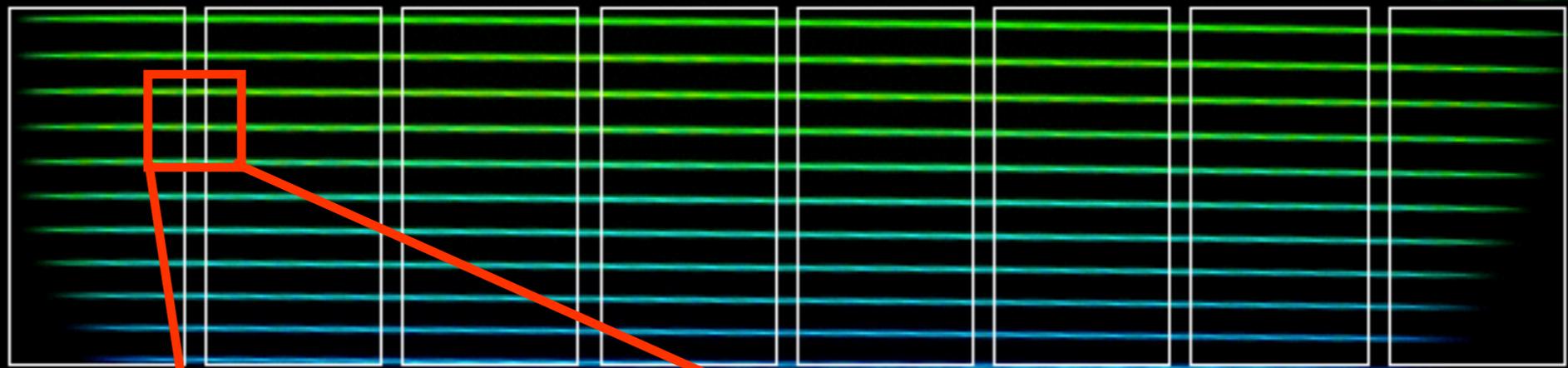
CCD Stitching



True

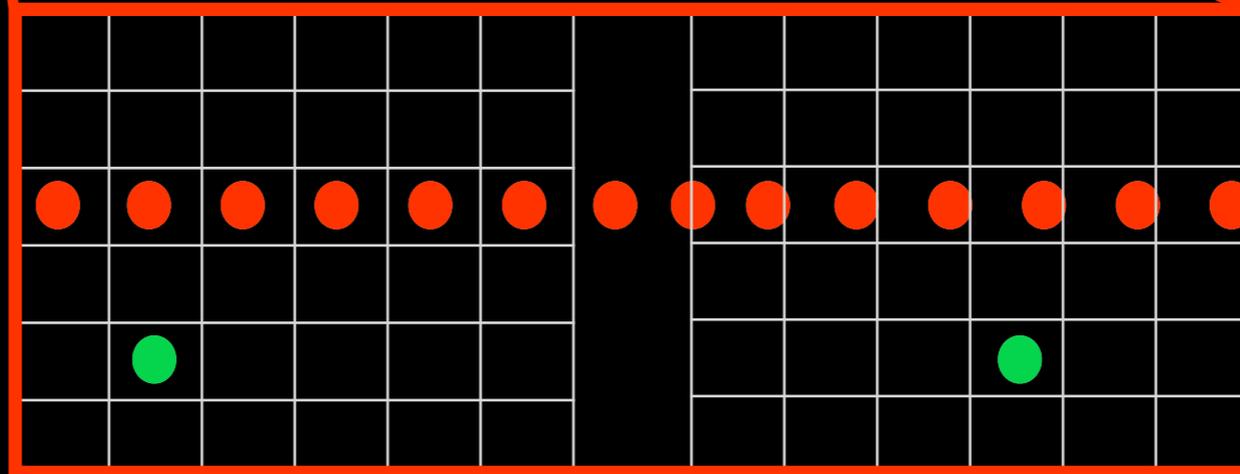


CCD Stitching

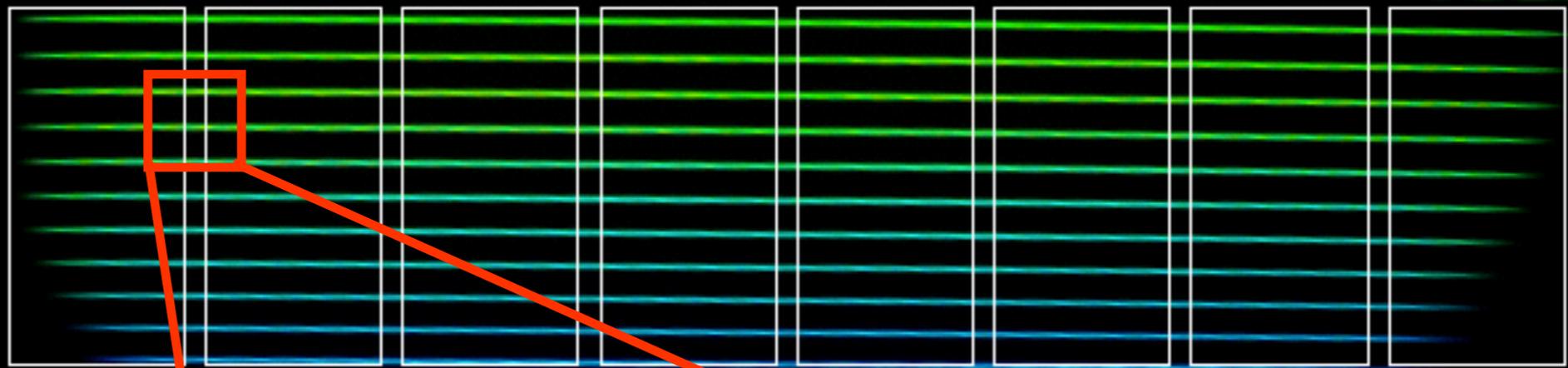


True

Laser FC
Thorium

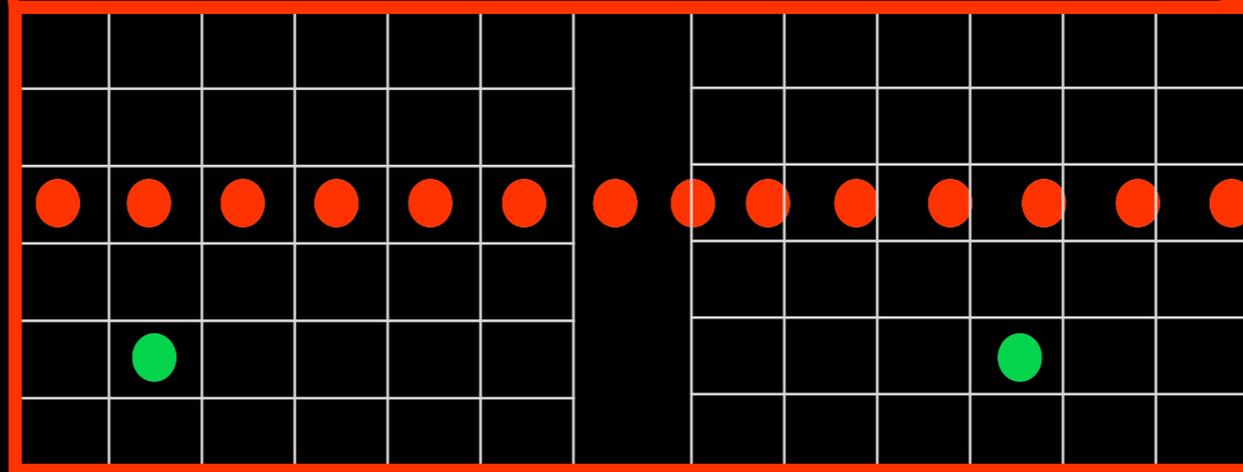


CCD Stitching



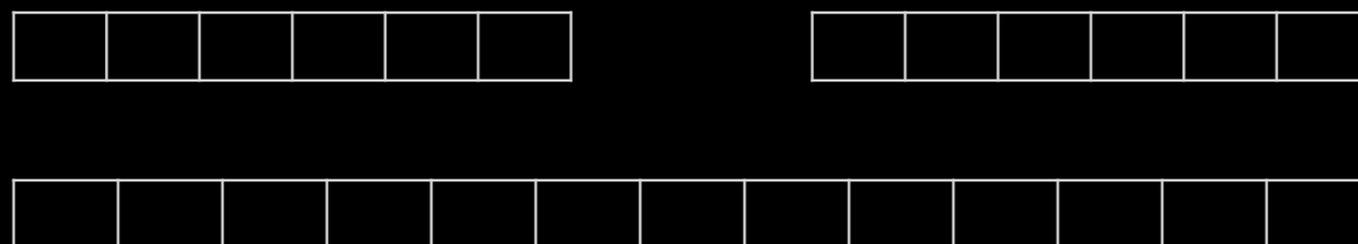
True

Laser FC
Thorium

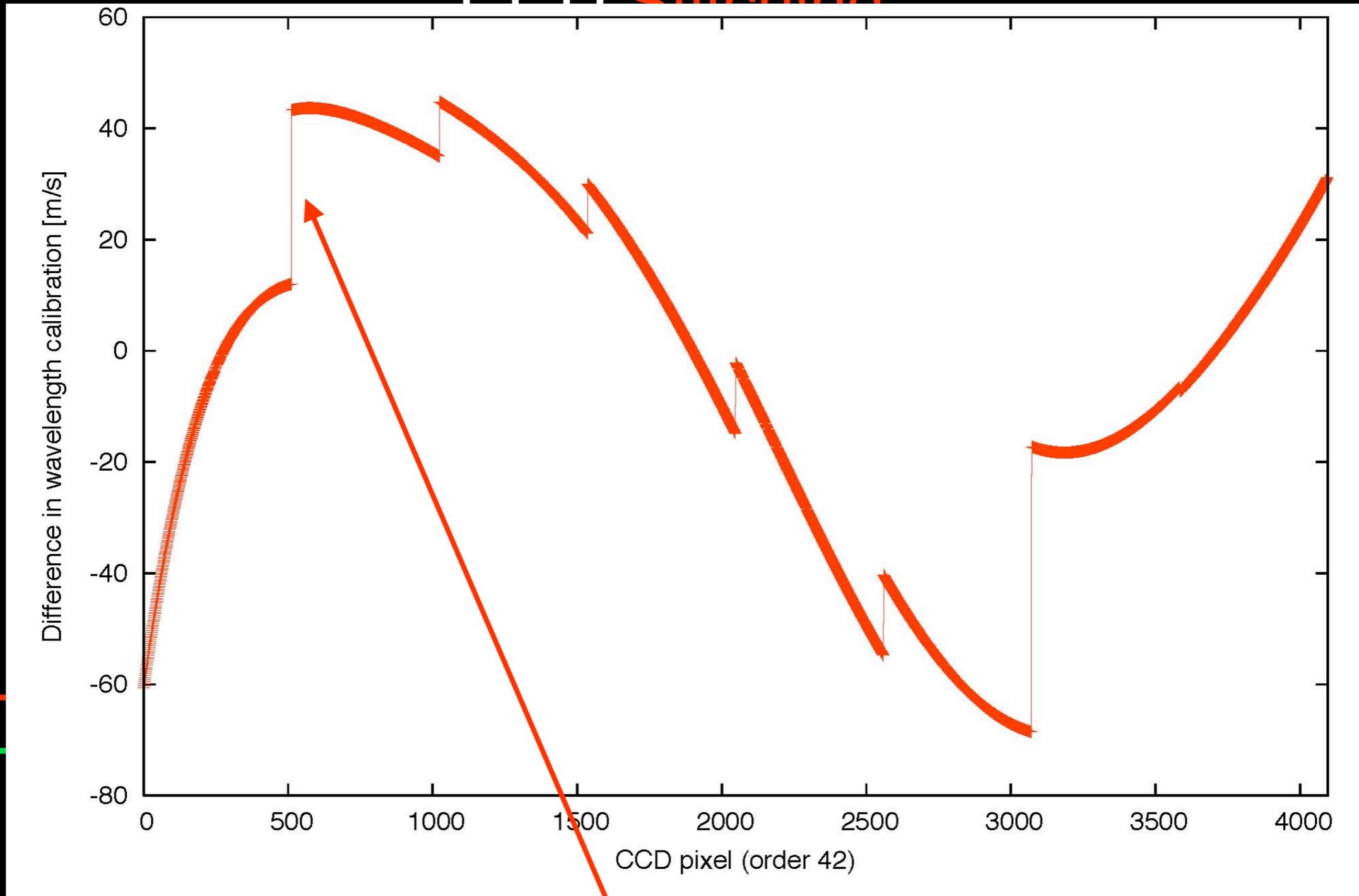


Observed

Laser FC
Thorium

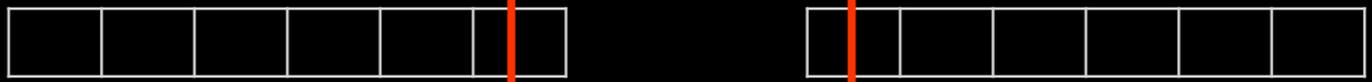


CCD Stitching



Observed

Laser FC

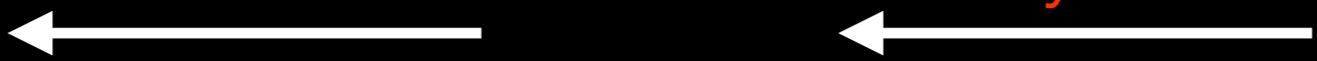


Thorium

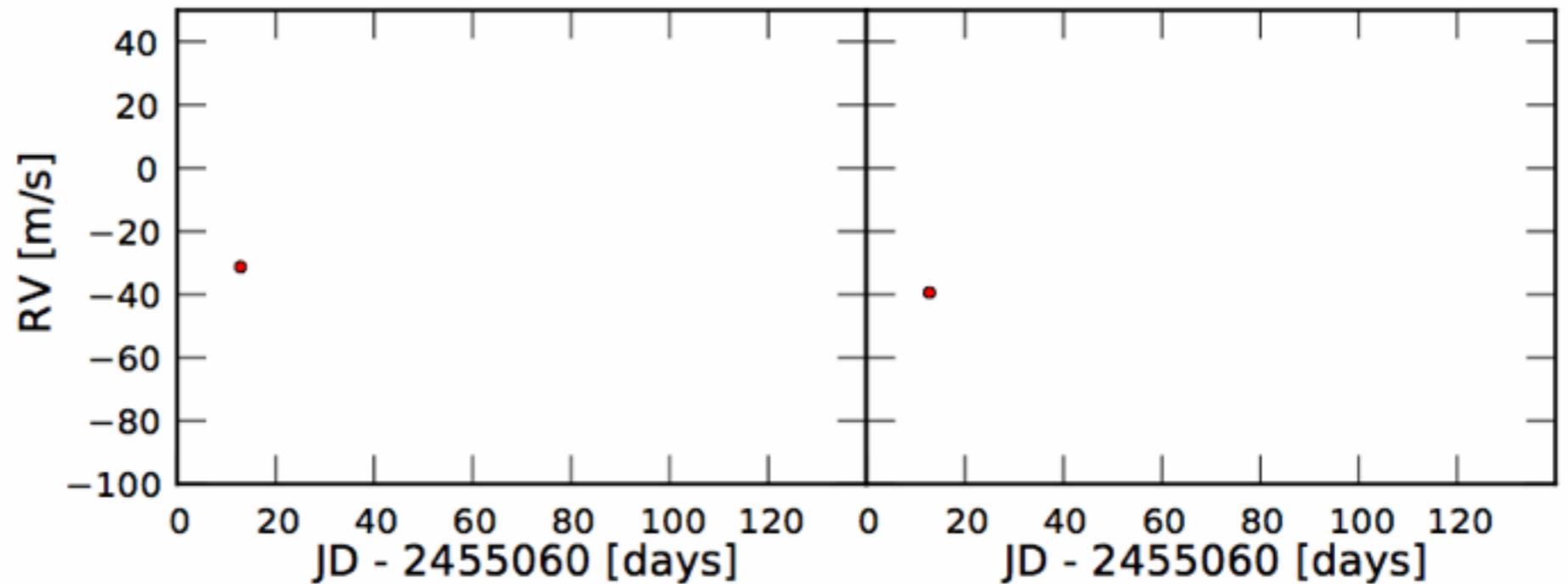
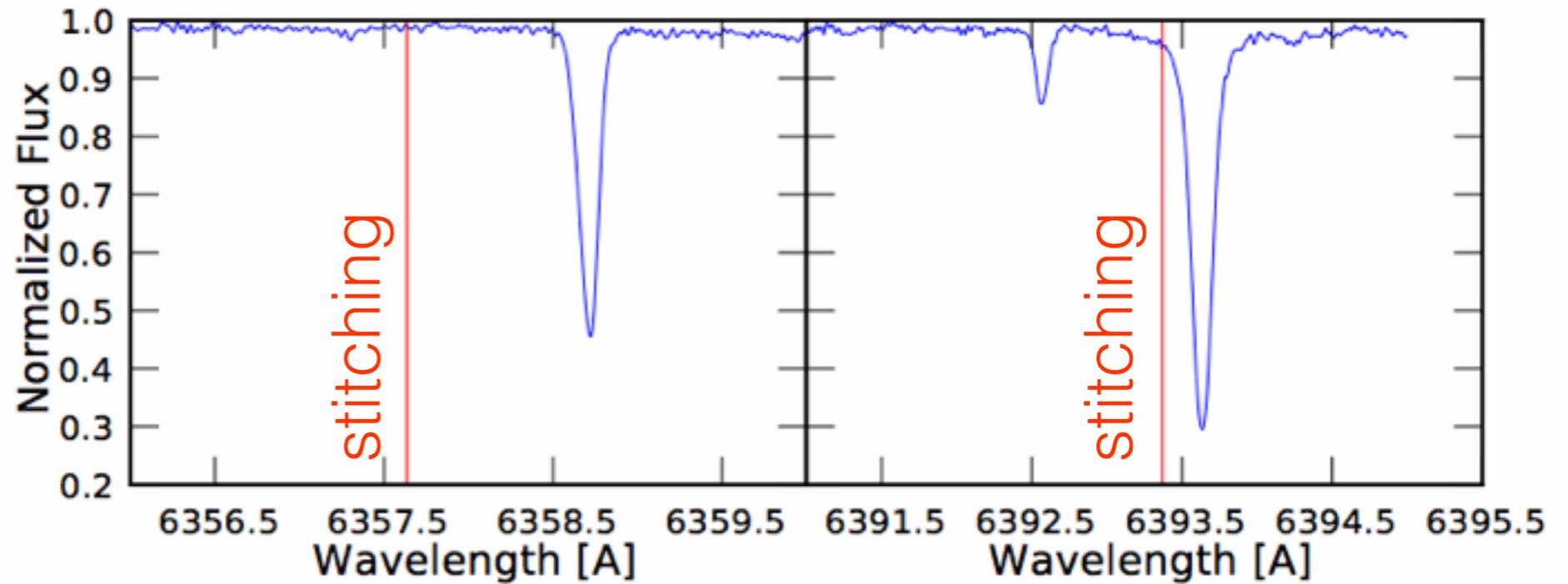


RV effect of CCD Stitching

Shift due to Earth velocity



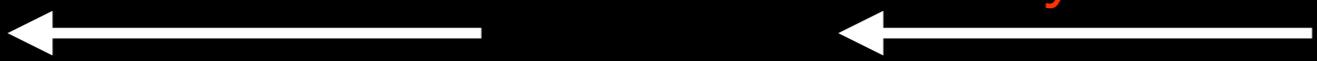
1 PIXEL
1 km/s



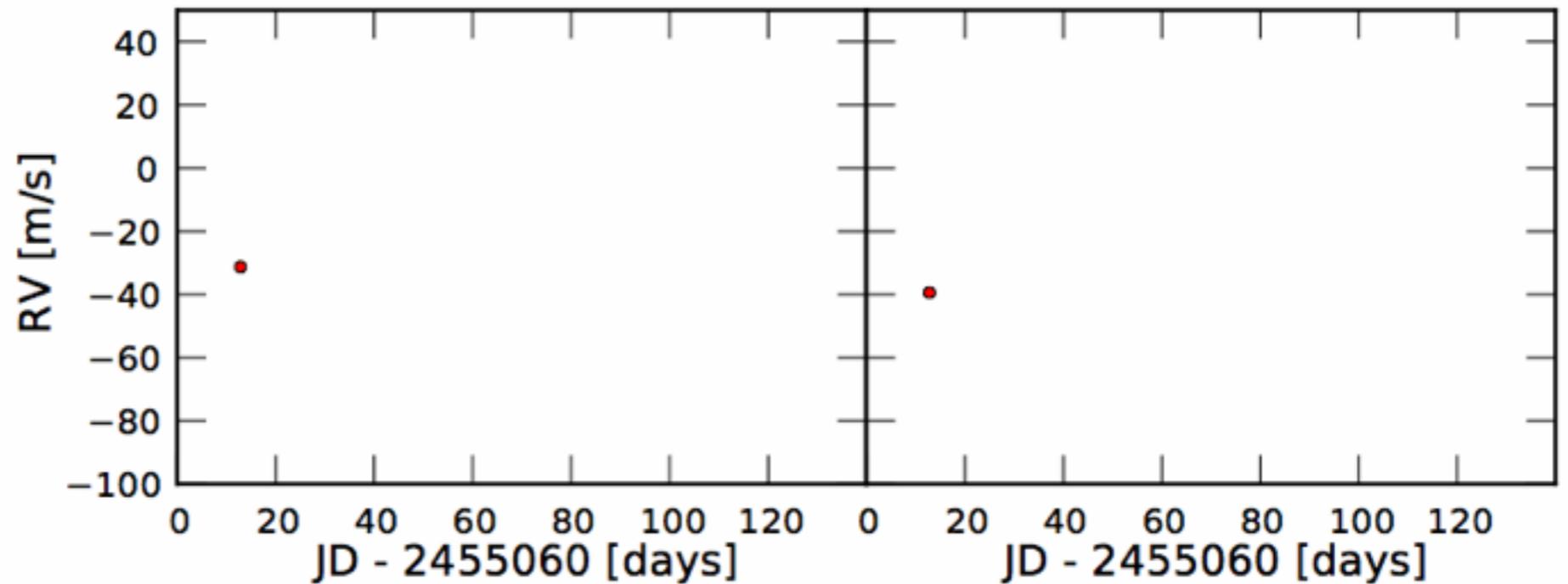
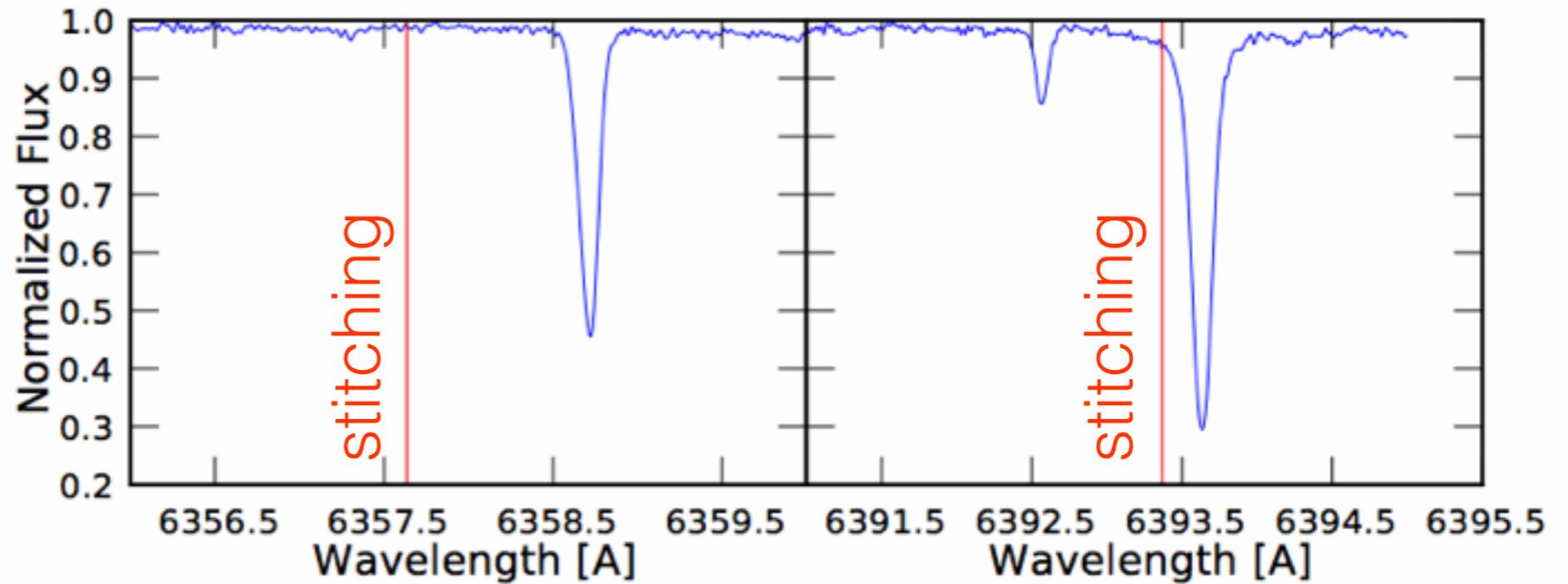
STITCHING
RV effect

RV effect of CCD Stitching

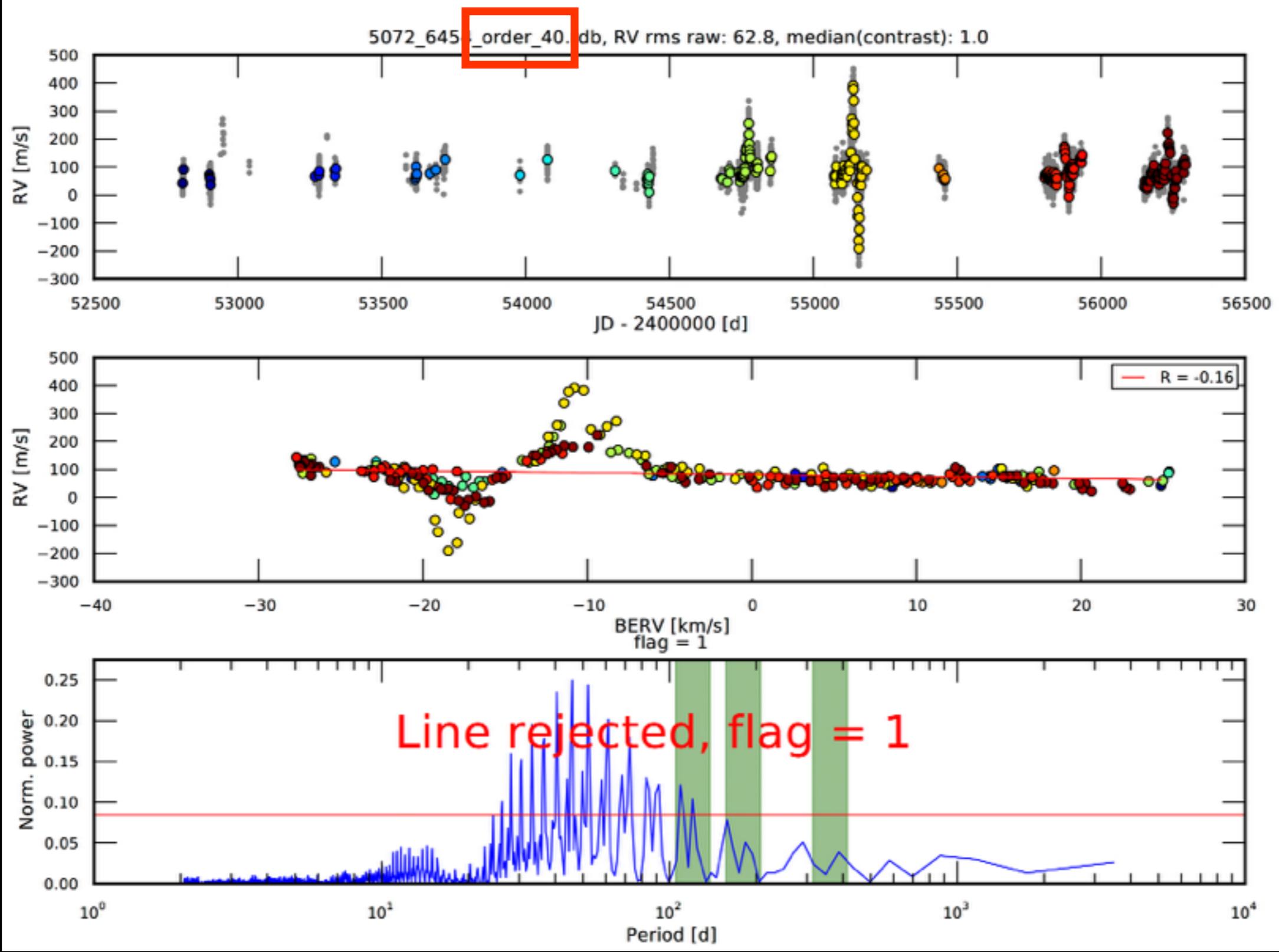
Shift due to Earth velocity



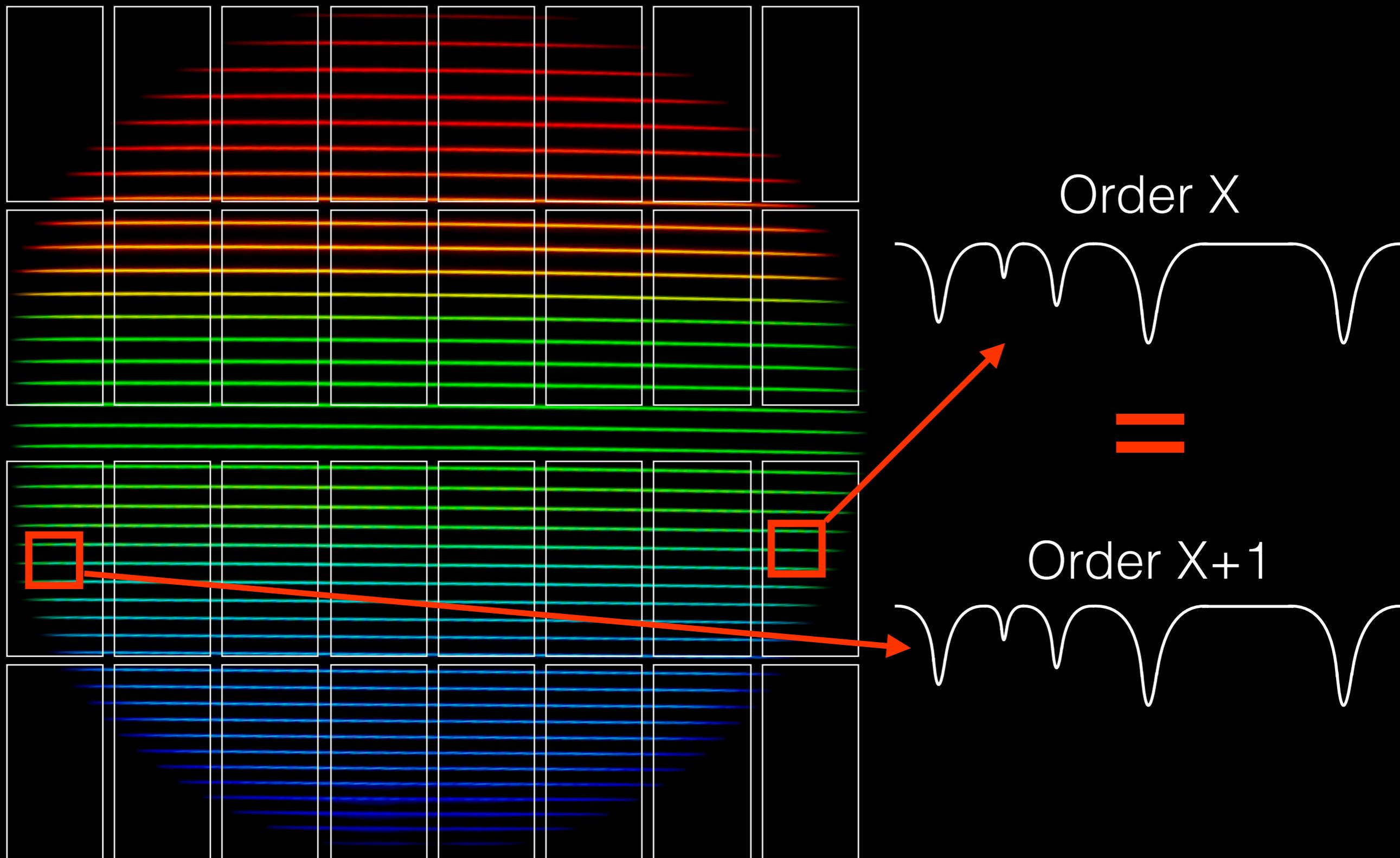
1 PIXEL
1 km/s



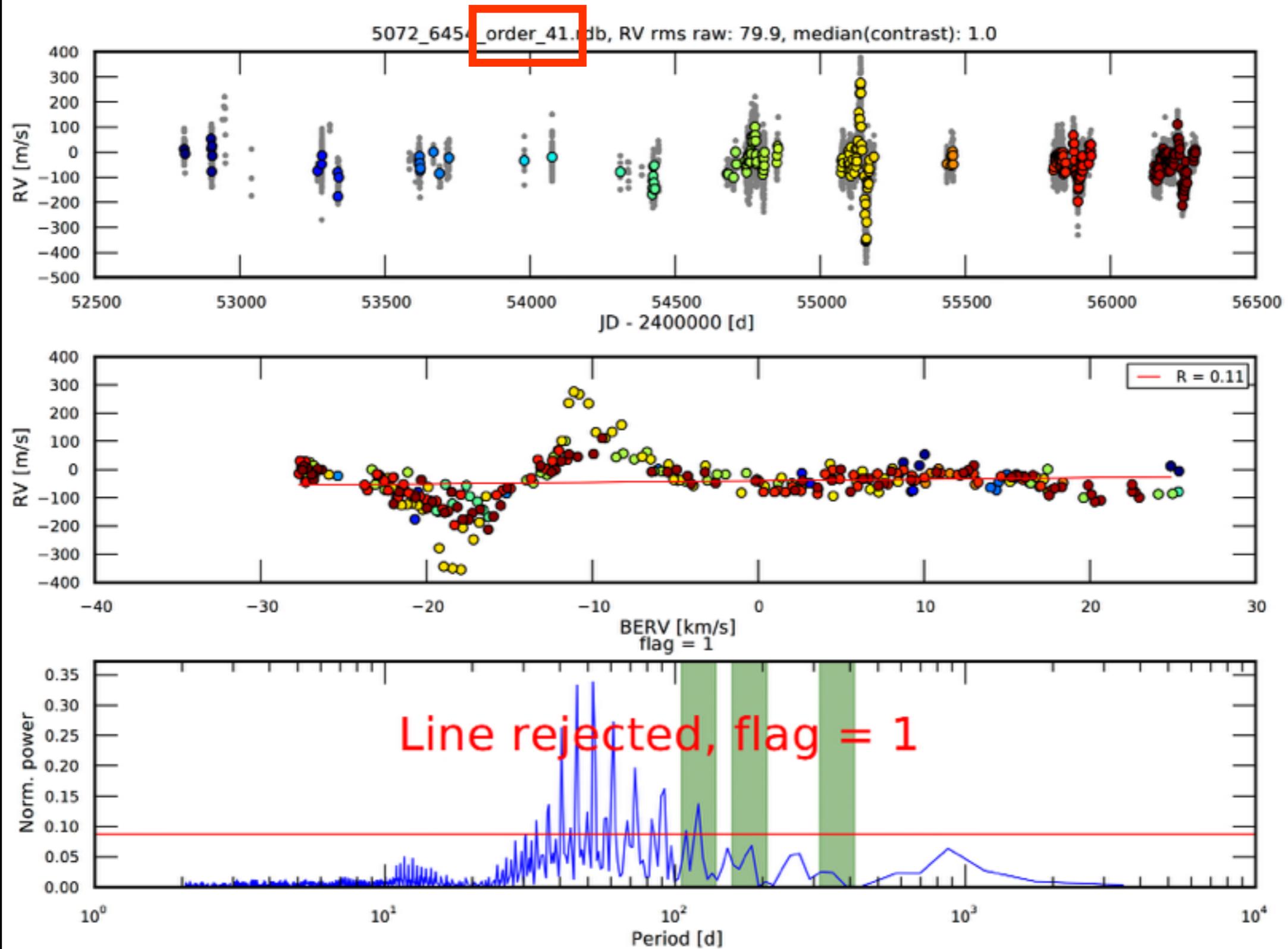
STITCHING
RV effect



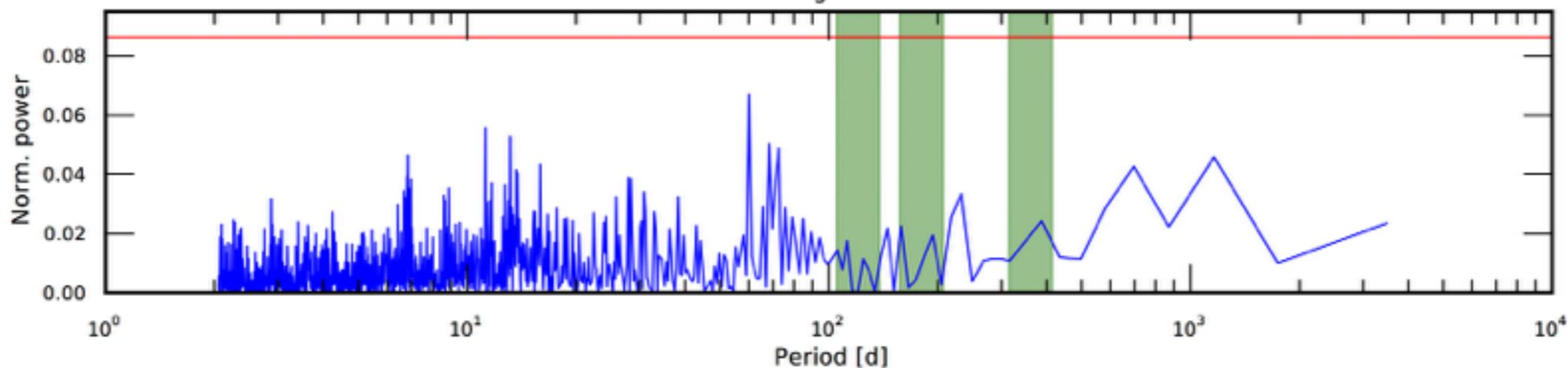
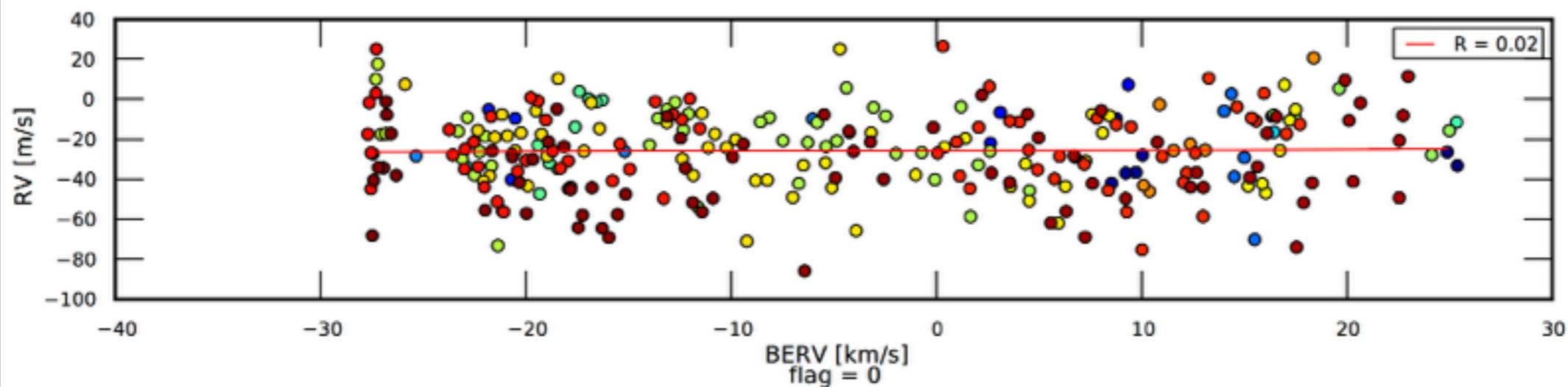
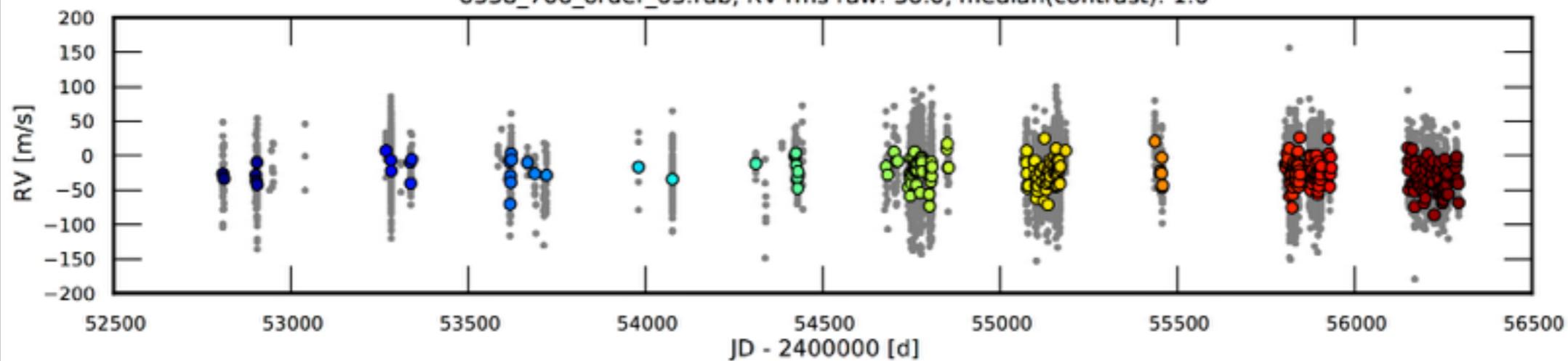
Overlapping orders



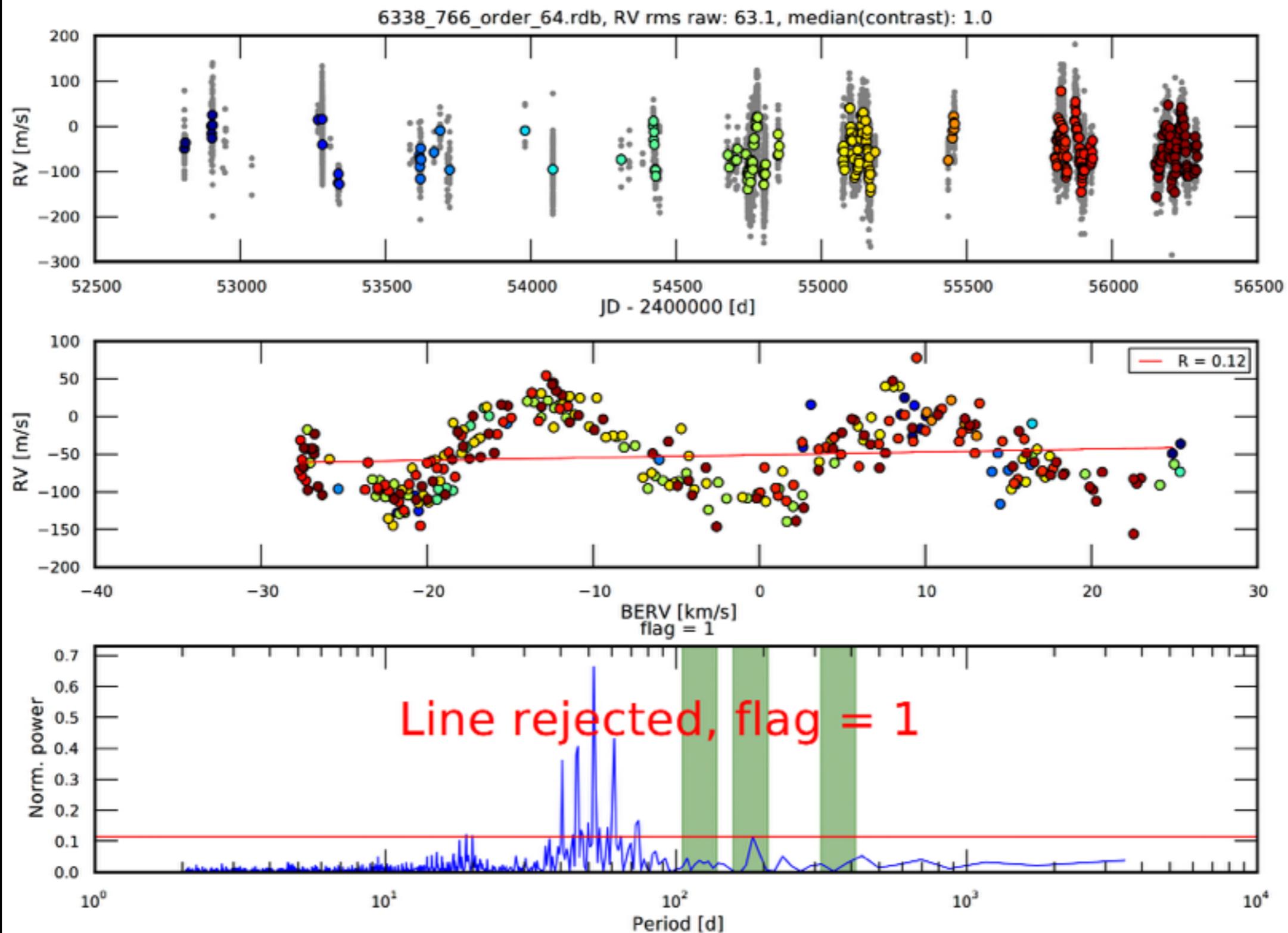
Next order also affected -> not CCD



6338_766_order_63.rdb, RV rms raw: 36.0, median(contrast): 1.0



Next order affected -> CCD Fringing



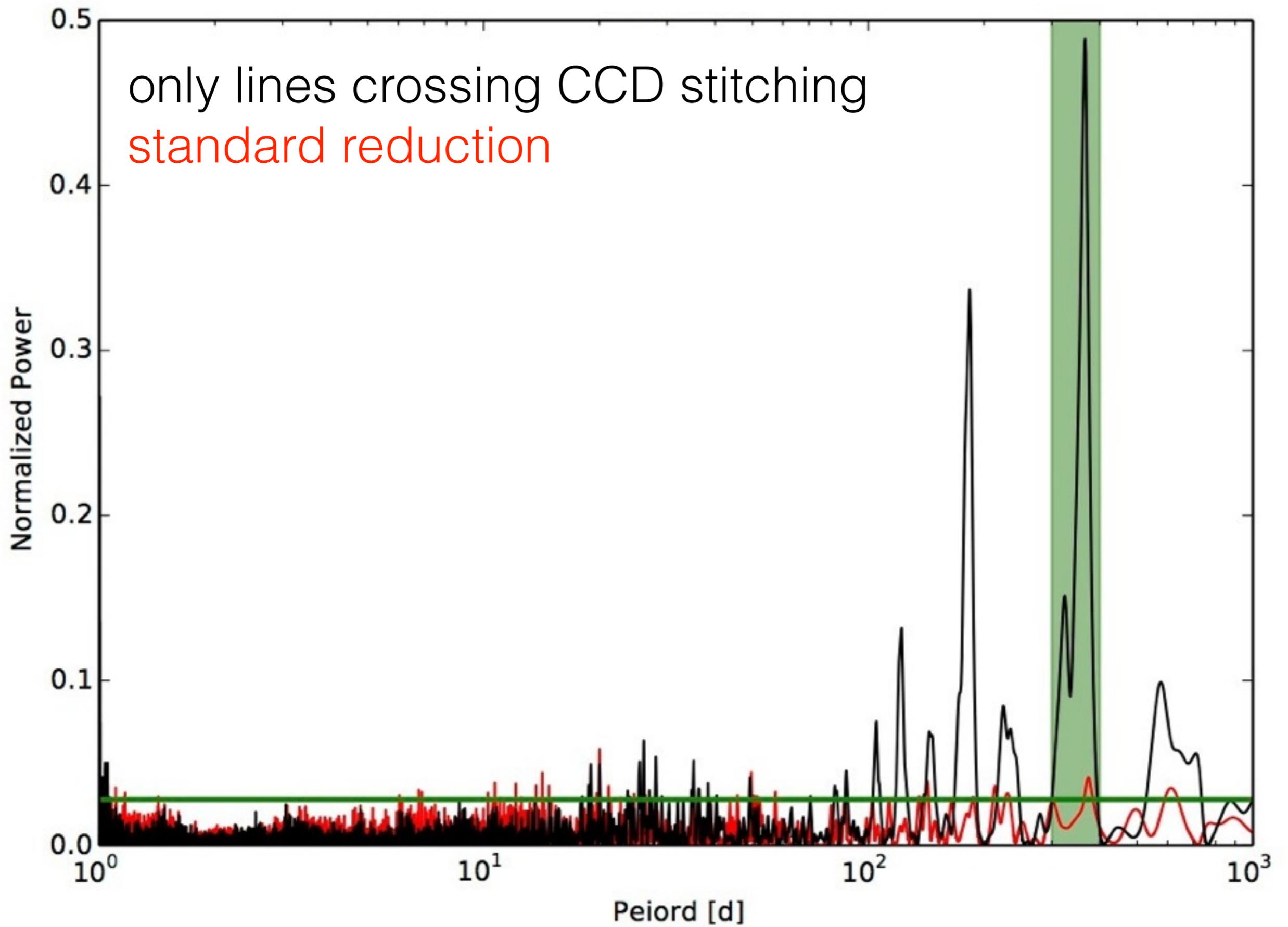
New

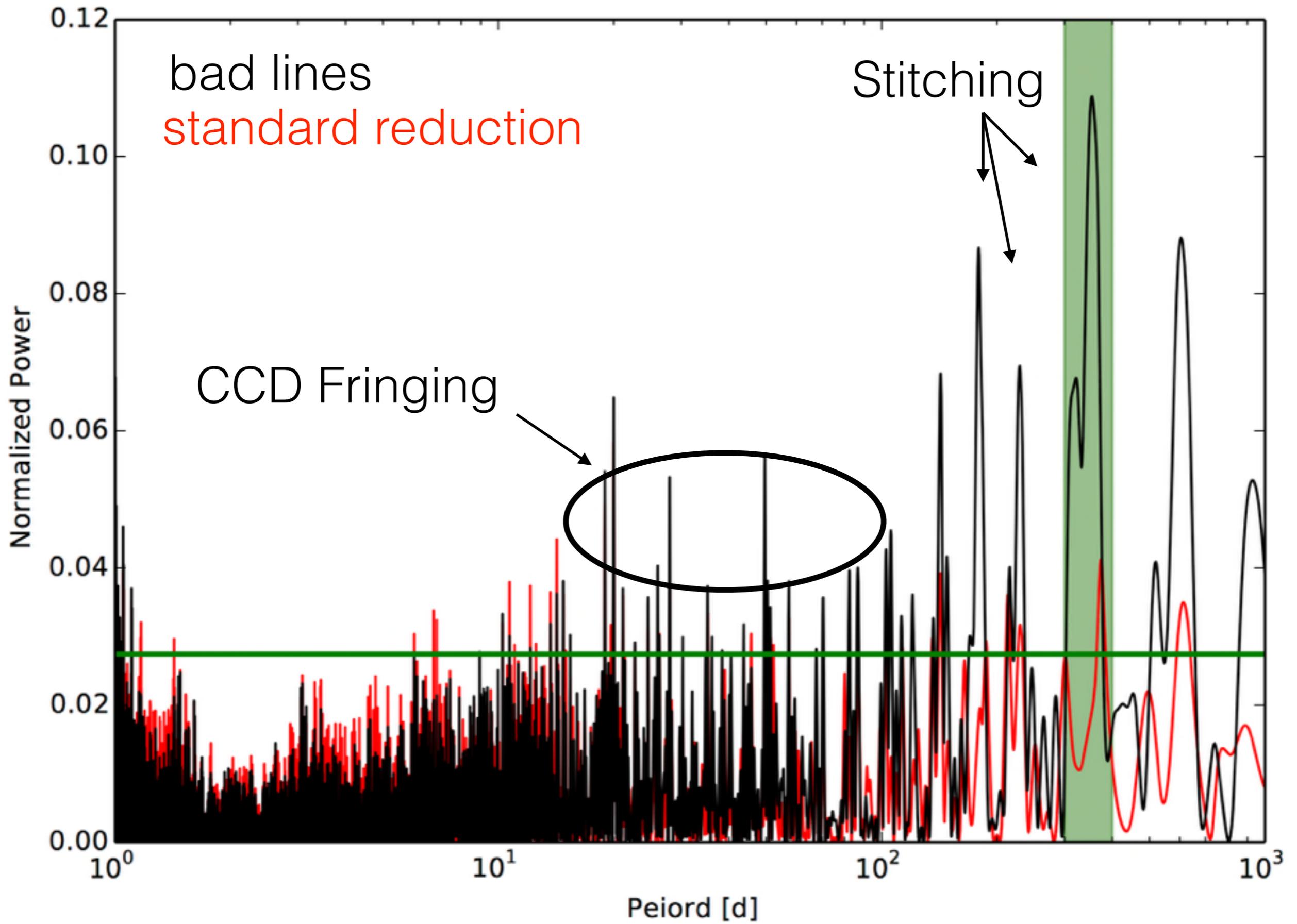
REDUCTION

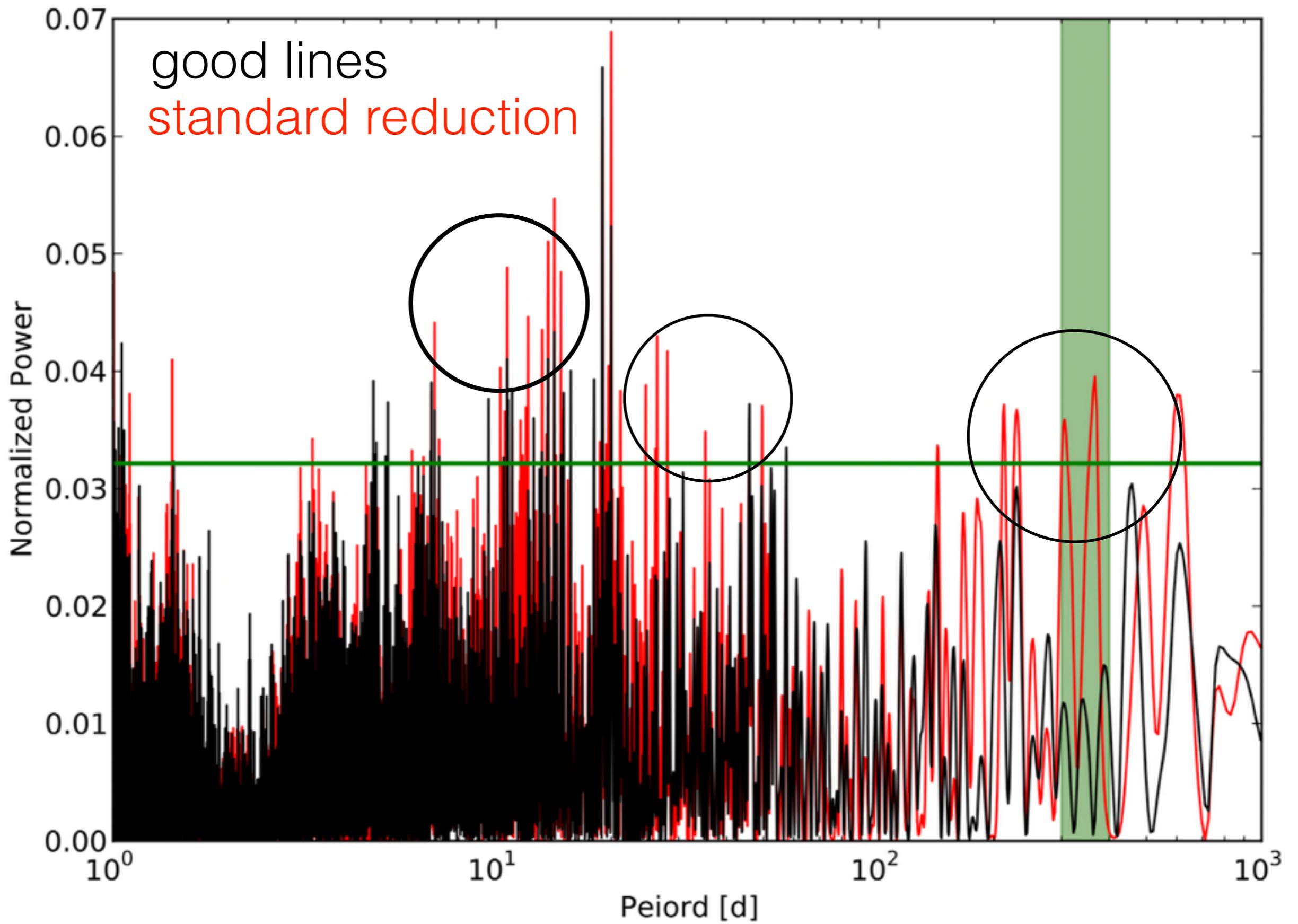
PRECISION At best 30 m/s

SIGNIFICANT SIGNAL Not stellar
signal

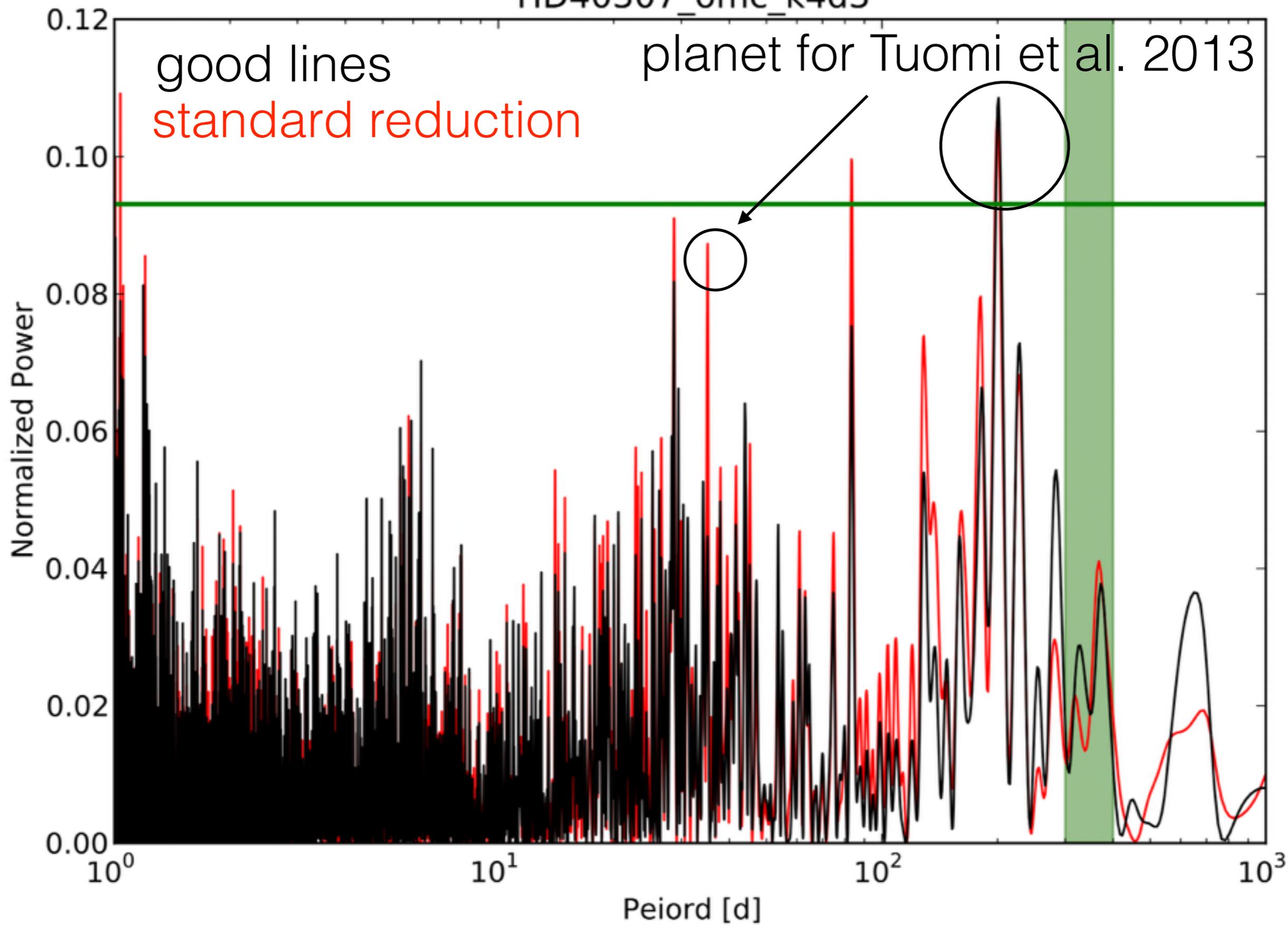
NEW REDUCTION Removing lines with
significant signals



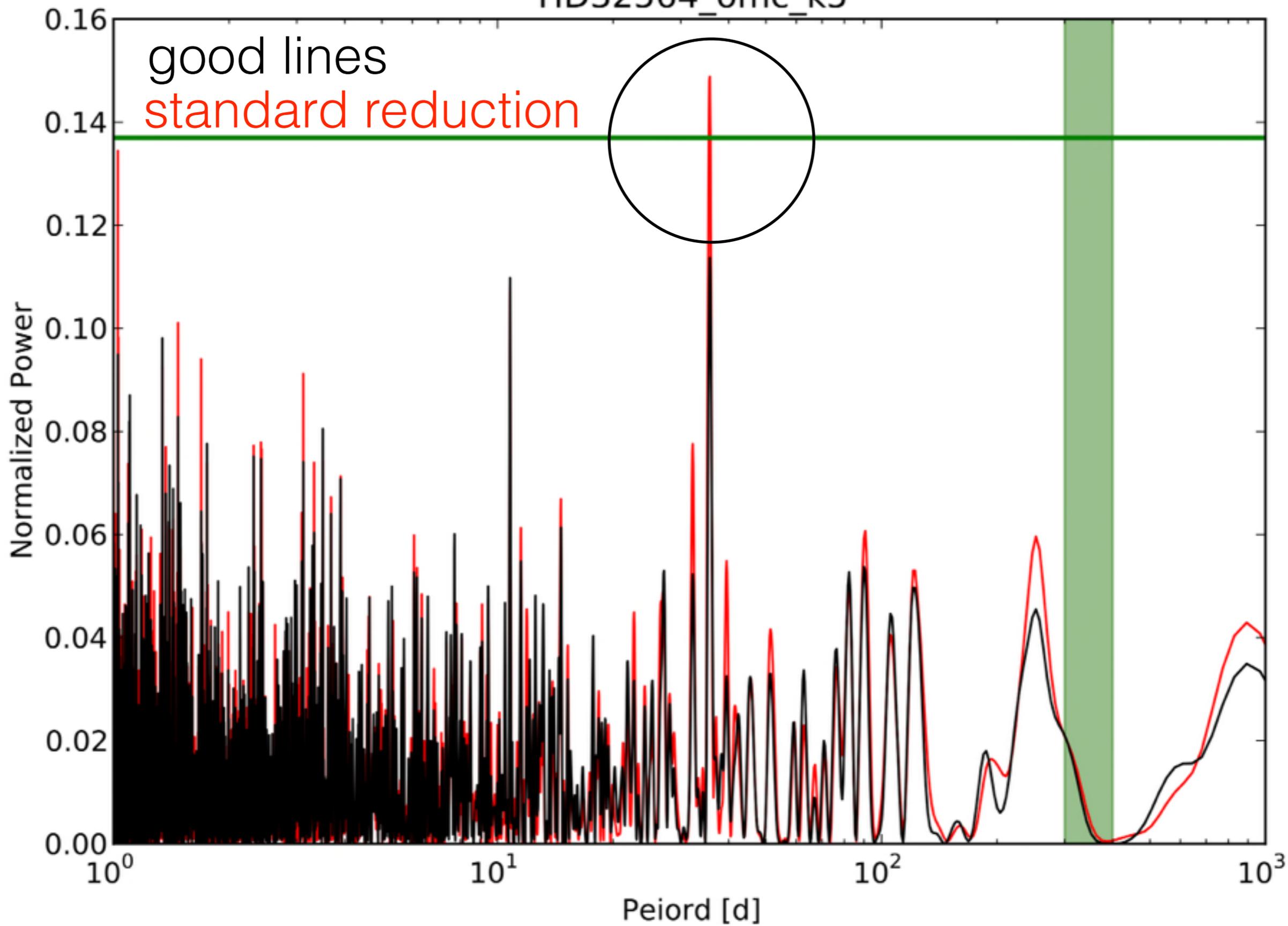




HD40307_omc_k4d3



HD32564_omc_k5



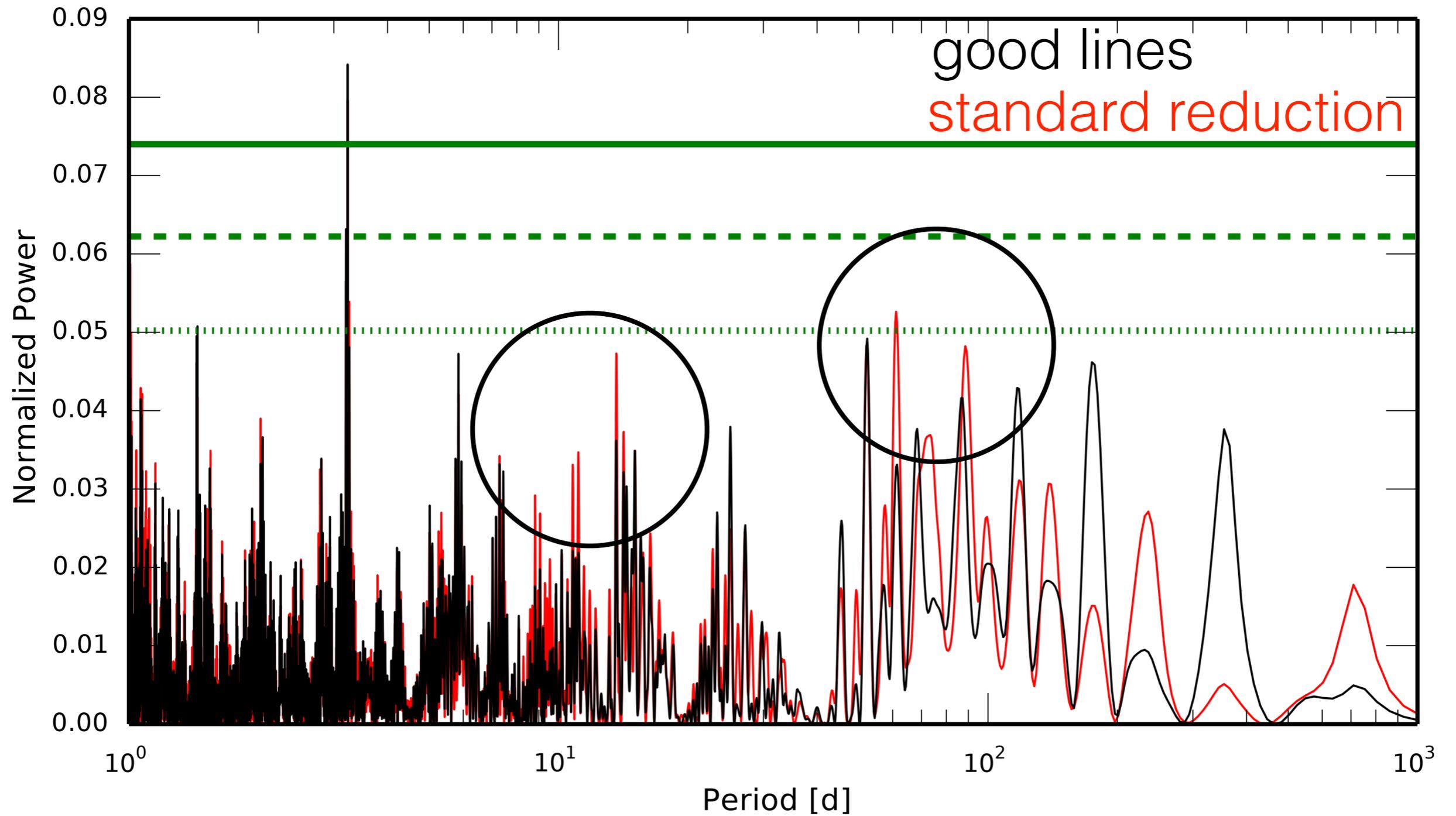
To do

Reduce the **entire HARPS database**

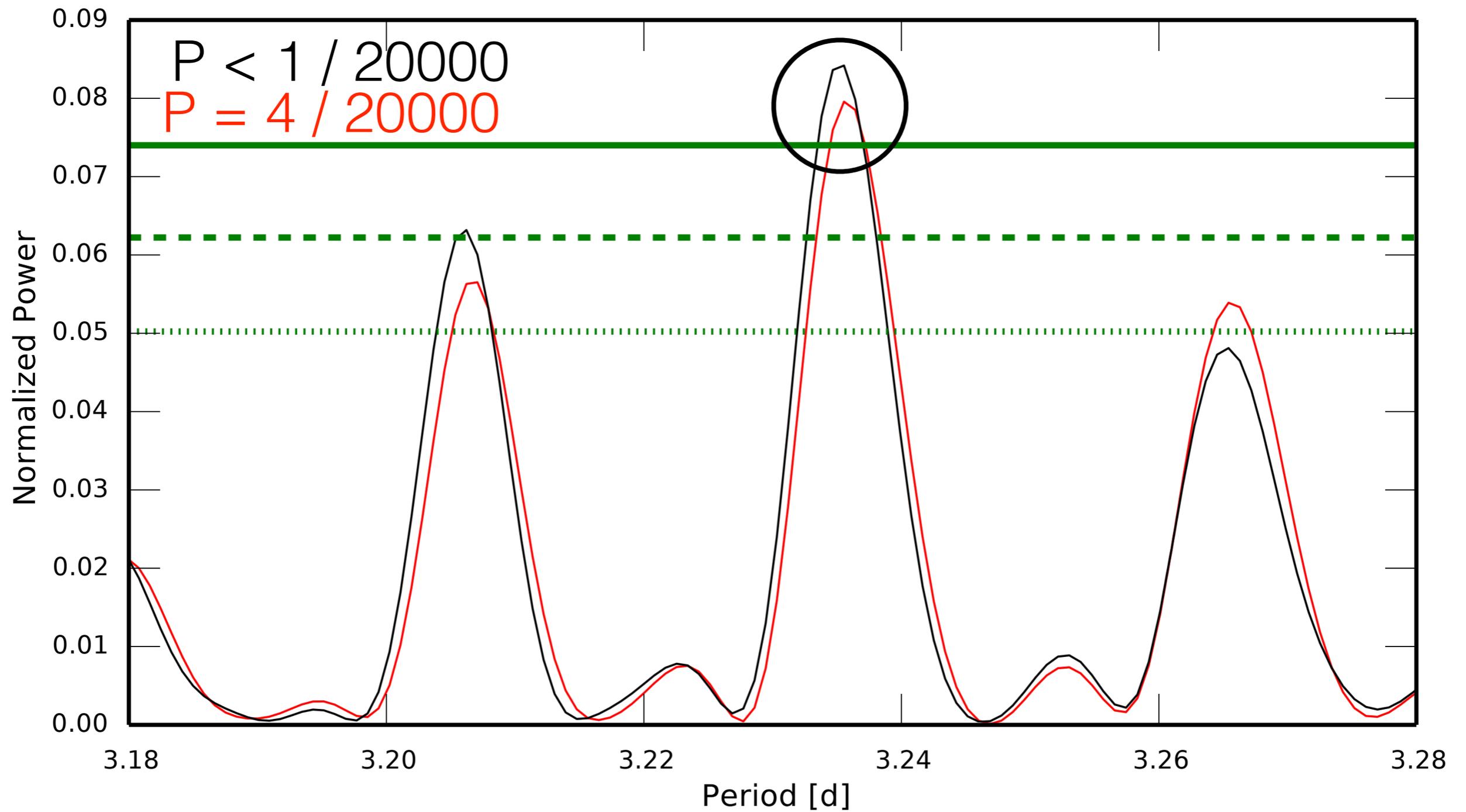
Look for **EXTRA PLANETARY** signals

Look for **FALSE** detections

Alpha Cen Bb



Alpha Cen Bb





END